

Core measurements

Three levels of observations are proposed for the CO₂/CLIVAR hydrographic section program with selection criteria listed in parentheses:

- ?? Level I core measurements (mandatory on all cruises; suggested standard for international collaborators; measured at highest spatial resolution practical; funded through the omnibus proposal across all cruises).
- ?? Level II recommended measurements (highly desirable on subset of US cruises; may be collected on coarser station spacing; coordinated with the core effort but funded by separate proposals either on a cruise by cruise basis or by specific measurement).
- ?? Level III ancillary measurements (on opportunity and space available basis; not to significantly interfere with Level I or II effort; may be regional or specific to individual cruise; extramural funding).

The focus of the working group is on level I measurements and there were different opinions on the number of measurements that should be included in the level I (core) measurements. The discussions centered around if the measurements that were necessary to accomplish all the objectives should be included in the omnibus proposal, or if core should focus on the "support" measurements needed by most investigators for interpretation of the data. The latter which were unanimously endorsed by the working group members are followed with a "****". We welcome input on all core measurements (level 1) measurements listed below but, in particular, we are seeking community input on the scope of the level 1 measurements.

*** Level I: rationale based on measurements required to directly quantify change in ocean carbon inventory, estimate anthropogenic CO₂ empirically, characterize large-scale water mass ventilation rates, constrain horizontal heat, freshwater, C, N, and O₂ transports and/or net divergence, and provide on-going basis for model evaluation.**

DIC dissolved inorganic carbon (DIC) ****

Total Alkalinity (TAlk) ****

CTD pressure, temperature, conductivity (salinity) ****

CTD oxygen (sensor)

Bottle salinity ****

Nutrients by standard auto analyzer (NO₃/NO₂, PO₄, SiO₃)****

Dissolved oxygen (O₂)****

Chlorofluoro carbon tracers CFC-11, -12, -113 ****

Tritium-³He

Total organic carbon

Total organic nitrogen

Surface underway system: T, S, pCO₂

ADCP shipboard****

ADCP lowered

*** Level II: related to large-scale carbon cycle and/or ventilation;**

specific rationale listed after measurement; possibly on coarser spatial resolution than Level I but on all cruises

pH	(internal carbonate system consistency)
discrete pCO ₂	(internal carbonate system consistency)
¹⁴ C by AMS	(bomb penetration; southern ocean circulation changes; may need to repeat only on 20 year time-scale)
CCl ₄ and SF ₆	(to extend range of age tracers further back in time (CCl ₄) and into the future (SF ₆))
del ¹³ C of DIC	(independent measure of anthropogenic CO ₂ uptake and inventory changes)
Fe/trace metals	(others? Zn? Al for dust? There are three sampling approaches -on "regular" rosette -Teflon/plastic water sampler hanging below CTD -Separate Kevlar wire; separate casts)
CTD transmissometer	(POC distribution; ambiguity as to calibration; regional?)
More complete surface underway system:	nutrients, O ₂ , Chl, DIC, surface skin temperature

*** Level III: focus on upper ocean biogeochemistry and cycling**

Chlorophyll	
Primary production	(on deck incubations)
HPLC pigments	(phytoplankton community composition)
Experimental continuous analyzers	(as they develop and can go full depth)
del ¹⁵ N NO ₃	(nutrient utilization)
³² Si	
¹⁸ O of H ₂ O	
NH ₄	
Low level nutrients	
Total organic phosphorus	(difficult to measure??)
Upper ocean optical profile	(similar to AMT line; algorithm development/ validation; short cast; needs to be coherent with biological sampling)
del ¹⁷ O of O ₂	(gross primary production)
methyl halides	(linkages to SOLAS)
DMS	(linkages to SOLAS)
ADCP (multibeam)	(optimized for (biological) particle enumeration)